MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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J. W. L. GLAISHER, M.A., Sc.D., President, in the Chair.

John Whitehouse Frederick Allnutt, B.A., 12 Chapel Row, Portsea;

Gainsford Bruce, Q.C., Yewhurst, Bromley, Kent;

Major Somerset H. Maxwell, Arley Cottage, Mount Nugent, Co. Cavan, Ireland; and

The Rev. Samuel Hickling Parkes, B.A., Swinton Industrial School, Manchester,

were balloted for and duly elected Fellows of the Society.

The Numerical Lunar Theory. By Sir G. B. Airy, K.C.B.

(*Extract from a letter to the Secretary.*)

In my "Numerical Lunar Theory," I pointed out certain discordances, the origin of which I could not trace, and which caused me great anxiety.

I have now, as I believe, discovered the source of error. In the operations of page 11, I have not carried the approximation sufficiently far. I ought to have included the eccentricities, especially that of the Terrestro-Lunar orbit. The mean value of this element (known from the coarsest observations) is about $\frac{1}{18}$, and this (comparatively) large quantity receives a large multiplier, before application to the genuine Lunar Theory.

The steps which I have already taken with this object fatigue me so much that I deem it necessary to suspend my work for a time. I hope before long to take it up again.

1887, *December* 29.

On the Double Star Σ 1847. By J. E. Gore.

Assuming that the change of position in this double star is due to uniform rectilinear motion, I have computed the following formulæ :—

$$\rho^2 = 179{\cdot}56 + 0{\cdot}0111\ (t - 1705{\cdot}12)^2.$$
$$\sec\ (\theta - 204^\circ{\cdot}10) = 0{\cdot}0746\ \rho.$$

The following is a comparison between the measures and the positions computed from the above formulæ :—

Epoch.	Observer.	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ_c	$\rho_o - \rho_c$
1829·8	Struve	248°·4	248°·5	−0°·1	18″·73	18″·76	−0″·03
1844·34	Mädler	251·5	251·6	−0·1	18·22	19·86	(−1·64)
1848·4	Mitchel	253·1	252·5	+0·6	20·17	20·18	−0·01
1865·4	Dembowski	256·0	255·7	+0·3	21·67	21·56	+0·11
1878·3	Burnham	257·8	257·8	0·0	22·63	22·64	−0·01

Assuming that the brighter star is the one in motion, the proper motion is 0″·1053 per annum in the direction of position-angle 114°·1.

For rectangular coordinates we have the formulæ—

$$\rho \sin\theta = 5{\cdot}4716 + [8{\cdot}9828203]\,(t - 1705{\cdot}12);$$
$$\rho \cos\theta = 12{\cdot}232 - [8{\cdot}6334402]\,(t - 1705{\cdot}12).$$

Ephemeris for Physical Observations of Mars, 1888. By A. Marth.

Greenwich Noon.	Angle of Position of ♂'s Axis.	Areographical Longit. of Centre of Disc.	Areographical Latit. of Centre of Disc.	Apparent Diameter.	q	Q	E	Log. of Light-ratio.
1888.	°	°	°	″	″	°	°	
Jan. 31	35·08	262·21	+20·24	8·63	0·77	290·68	34·71	9·2534
Feb. 2	35·22	243·41	+20·08	8·79	0·77	290·51	34·43	9·2702
4	35·35	224·64	19·92	8·95	·77	290·33	34·13	·2873
6	35·47	205·90	19·77	9·12	·77	290·16	33·80	·3047
8	35·58	187·20	19·62	9·29	·77	289·98	33·44	·3223
10	35·68	168·53	19·48	9·47	·77	289·80	33·05	·3401
12	35·77	149·89	19·34	9·65	·76	289·63	32·62	·3582
14	35·85	131·29	19·22	9·84	·75	289·46	32·15	·3765
16	35·93	112·72	19·10	10·03	·75	289·29	31·65	·3950
18	35·99	94·20	18·99	10·23	·74	289·11	31·11	·4137
20	36·04	75·71	18·89	10·43	·72	288·94	30·53	·4325
22	36·09	57·26	18·81	10·64	·71	288·76	29·91	·4514
24	36·13	38·85	18·73	10·85	·69	288·59	29·25	·4705
26	36·16	20·49	18·67	11·07	·67	288·41	28·54	·4896
28	36·18	2·17	18·62	11·29	·65	288·23	27·79	·5087
Mar. 1	36·20	343·89	+18·59	11·51	0·63	288·05	26·99	9·5279

Greenwich Noon. 1888.	Angle of Position of ♂'s Axis.	Areographical Longit. of Centre	Latit. of Disc.	Apparent Diameter.	q	Q	E	Log. of Light-ratio.
	°	°	°	″	″	°	°	
Mar. 3	36·21	325·66	18·57	11·74	0·60	287·87	26·15	·5470
5	36·21	307·48	18·56	11·97	·57	287·68	25·26	·5661
7	36·20	289·34	18·57	12·20	·54	287·48	24·31	·5850
9	36·18	271·26	18·60	12·43	·51	287·28	23·31	·6037
11	36·15	253·23	18·64	12·66	·47	287·06	22·26	·6222
13	36·11	235·24	18·70	12·89	·43	286·83	20·16	·6404
15	36·07	217·31	18·77	13·12	·40	286·57	20·00	·6582
17	36·01	199·43	18·86	13·35	·36	286·28	18·79	·6755
19	35·95	181·60	18·97	13·57	·32	285·95	17·53	·6922
21	35·87	163·82	19·09	13·79	·27	285·57	16·21	·7083
23	35·78	146·09	19·23	14·00	·23	285·11	14·85	·7237
25	35·68	128·40	19·38	14·20	·19	284·54	13·44	·7384
27	35·57	110·76	19·55	14·40	·16	283·83	11·99	·7522
29	35·45	93·16	19·73	14·58	·12	282·89	10·50	·7650
31	35·32	75·59	19·92	14·74	·09	281·60	8·97	·7769
Apr. 2	35·17	58·06	+20·12	14·90	0·06	279·73	7·41	9·7877
4	35·01	40·56	20·33	15·03	·04	276·8	5·83	·7973
6	34·84	23·09	20·55	15·15	·02	271·6	4·25	·8057
8	34·66	5·63	20·77	15·25	·01	260·2	2·72	·8128
10	34·47	348·19	20·99	15·34	·00	226·6	1·54	·8186
12	34·27	330·76	21·22	15·40	·00	164·1	1·71	·8231
14	34·06	313·34	21·45	15·44	·01	137·5	3·05	·8262
16	33·85	295·91	21·68	15·46	·03	128·0	4·62	·8280
18	33·63	278·47	21·91	15·45	·05	123·4	6·26	·8284
20	33·42	261·01	22·13	15·43	·07	120·71	7·90	·8275
22	33·20	243·53	22·34	15·39	·11	118·99	9·53	·8254
24	32·99	226·02	22·55	15·33	·15	117·79	11·15	·8220
26	32·78	208·48	22·75	15·25	·19	116·91	12·75	·8174
28	32·58	190·90	22·95	15·16	·24	116·24	14·31	·8118
30	32·39	173·28	23·14	15·05	·29	115·72	15·84	·8051
May 2	32·22	155·61	+23·31	14·92	0·34	115·30	17·33	9·7974
4	32·05	137·89	23·48	14·79	·39	114·95	18·78	·7888
6	31·90	120·13	23·64	14·64	·45	114·66	20·18	·7795
8	31·77	102·31	23·79	14·48	·50	114·42	21·54	·7694
10	31·65	84·43	23·93	14·31	·56	114·21	22·84	·7586
12	31·55	66·50	24·06	14·14	·62	114·03	24·10	·7472
14	31·47	48·50	24·18	13·96	·67	113·88	25·30	·7354
16	31·41	30·45	24·29	13·77	·72	113·74	26·46	·7231

Greenwich Noon.	Angle of Position of ♂'s Axis.	Areographical Longit. of Centre	Areographical Latit. of Disc.	Apparent Diameter.	q	Q	E	Log. of Light-ratio.
1888.	°	°	°	″	″	°	°	
May 18	31·37	12·34	24·39	13·58	0·77	113·62	27·56	·7105
20	31·35	354·17	24·48	13·39	·82	113·51	28·61	·6976
22	31·35	335·94	24·56	13·20	·86	113·41	29·62	·6844
24	31·37	317·65	24·63	13·01	·90	113·32	30·57	·6711
26	31·41	299·31	24·69	12·82	·94	113·24	31·48	·6577
28	31·47	280·92	24·74	12·63	0·98	113·17	32·34	·6442
30	31·55	262·47	24·79	12·44	1·01	113·10	33·16	·6307
June 1	31·64	243·97	+24·82	12·25	1·04	113·03	33·93	9·6171
3	31·75	225·42	24·85	12·07	1·07	112·96	34·66	·6036
5	31·88	206·82	24·86	11·89	1·09	112·89	35·35	·5902
7	32·02	188·18	24·87	11·71	1·12	112·84	36·00	·5768
9	32·17	169·49	24·86	11·53	1·14	112·78	36·61	·5635
11	32·34	150·76	24·85	11·36	1·16	112·72	37·19	·5504
13	32·52	131·99	24·83	11·19	1·17	112·66	37·73	·5374
15	32·71	113·17	24·79	11·02	1·18	112·60	38·24	·5246
17	32·91	94·32	24·75	10·86	1·19	112·54	38·72	·5120
19	33·12	75·43	24·69	10·70	1·20	112·47	39·16	·4995
21	33·34	56·51	24·63	10·55	1·21	112·40	39·57	·4873
23	33·56	37·55	24·55	10·40	1·21	112·33	39·96	·4753
25	33·79	18·57	24·47	10·25	1·22	112·25	40·32	·4635
27	34·02	359·55	24·37	10·11	1·22	112·17	40·65	·4519
29	34·25	340·50	24·26	9·97	1·22	112·09	40·96	·4405
July 1	34·49	321·43	+24·14	9·84	1·22	112·00	41·24	9·4293
3	34·72	302·33	24·01	9·71	1·22	111·90	41·50	·4183
5	34·96	283·21	23·87	9·58	1·22	111·80	41·75	·4076
7	35·20	264·06	23·71	9·45	1·21	111·69	41·97	·3971
9	35·43	244·89	23·55	9·33	1·21	111·57	42·17	·3867
11	35·66	225·70	23·37	9·21	1·20	111·45	42·35	·3766
13	35·89	206·48	23·18	9·10	1·20	111·32	42·52	·3668
15	36·11	187·25	22·98	8·99	1·19	111·18	42·66	·3571
17	36·33	168·00	22·76	8·88	1·18	111·04	42·79	·3477
19	36·53	148·74	22·53	8·77	1·17	110·88	42·90	·3384
21	36·73	129·46	22·29	8·67	1·17	110·72	43·00	·3294
23	36·92	110·16	22·04	8·57	1·16	110·55	43·09	·3206
25	37·10	90·85	21·77	8·47	1·15	110·37	43·16	·3120
27	37·27	71·53	21·50	8·38	1·14	110·17	43·22	·3036
29	37·43	52·20	21·21	8·29	1·13	109·97	43·26	·2953
31	37·58	32·85	20·91	8·20	1·12	109·76	43·29	·2872
Aug. 2	37·71	13·49	+20·59	8·11	1·10	109·54	43·32	9·2793

Q denotes the position-angle and q the amount of the greatest defect of illumination; E the areocentric angle between Earth and Sun. The last column gives the logarithm of the ratio of the apparent brightness of *Mars* to that at mean opposition, the diminution of brightness due to the phase being assumed to depend simply on the proportion of the unilluminated portion to the whole of the disc.

The data of the ephemeris are to be interpolated directly for the times for which they are required, the equation of light having already been taken into account. The differences of successive values of the areographical longitude of the centre amount to one rotation and some 340 degrees, so that the greatest difference, April 12 to 14, is 702°·58, and the smallest, July 31 to August 2, 700°·64, which must be borne in mind in interpolating.

The ephemeris is founded upon the same elements as that for 1886 in vol. xlvi.

The adopted zero-meridian will be apparently directed to the Earth or will pass the centre of the disc of *Mars* at the following Greenwich mean times:—

1888.	h	m	1888.	h	m	1888.	h	m
Jan. 31	6	41·7	Feb. 22	20	42·8	Mar. 16	10	22·0
Feb. 1	7	10·3	23	21	20 5	17	10	58·6
2	7	58·9	24	21	58·2	18	11	35 2
3	8	37·4	25	22	35·9	19	12	11·7
4	9	15·9	26	23	13 5	20	12	48·1
5	9	54·4	27	23	51·1	21	13	24·6
6	10	32·8	29	0	28 6	22	14	0·9
7	11	11·2	Mar. 1	1	6·1	23	14	37·2
8	11	49·6	2	1	43·5	24	15	13·5
9	12	28·0	3	2	20·9	25	15	49·7
10	13	6·3	4	2	58·2	26	16	25·9
11	13	44·5	5	3	35·5	27	17	2·0
12	14	22·7	6	4	12·8	28	17	38·1
13	15	0·9	7	4	49·9	29	18	14·1
14	15	39·1	8	5	27·0	30	18	50·1
15	16	17·2	9	6	4·1	31	19	26·1
16	16	55 3	10	6	41·1	Apr. 1	20	2·0
17	17	33·3	11	7	18·0	2	20	37·9
18	18	11·3	12	7	54·9	3	21	13·7
19	18	49·2	13	8	31·8	4	21	49·6
20	19	27·1	14	9	8·6	5	22	25·4
21	20	5 0	15	9	45 3	6	23	1·2

1888.	h	m
Apr. 7	23	36·9
9	0	12·7
10	0	48·4
11	1	24·1
12	1	59·9
13	2	35·6
14	3	11·3
15	3	47·0
16	4	22·7
17	4	58·5
18	5	34·2
19	6	10·0
20	6	45·8
21	7	21·6
22	7	57·5
23	8	33·4
24	9	9·3
25	9	45·2
26	10	21·2
27	10	57·3
28	11	33·4
29	12	9·5
30	12	45·7
May 1	13	21·9
2	13	58·2
3	14	34·5
4	15	10·9
5	15	47·3
6	16	23·8
7	17	0·4
8	17	37·0
9	18	13·7
10	18	50·4
11	19	27·2
12	20	4·1
13	20	41·0
14	21	18·0
15	21	55·1
16	22	32·2
17	23	9·4
18	23	46·6
20	0	23·9
21	1	1·3
22	1	38·7
23	2	16·2
24	2	53·8
25	3	31·4
26	4	9·1
27	4	46·9
28	5	24·7
29	6	2·5
30	6	40·4
31	7	18·4
June 1	7	56·4
2	8	34·5
3	9	12·6
4	9	50·8
5	10	29·0
6	11	7·3
7	11	45·6
8	12	24·0
9	13	2·4
10	13	40·8
11	14	19·3
12	14	57·9
13	15	36·5
14	16	15·2
15	16	53·9
16	17	32·6
17	18	11·4
18	18	50·2
19	19	29·0
20	20	7·9
21	20	46·8
22	21	25·7
23	22	4·7
24	22	43·7
25	23	22·8
27	0	1·9
28	0	41·0
29	1	20·1
30	1	59·3
July 1	2	38·5
2	3	17·7
3	3	57·0
4	4	36·2
5	5	15·5
6	5	54·9
7	6	34·2
8	7	13·6
9	7	53·0
10	8	32·5
11	9	11·9
12	9	51·4
13	10	30·9
14	11	10·4
15	11	50·0
16	12	29·5
17	13	9·1
18	13	48·7
19	14	28·3
20	15	7·9
21	15	47·5
22	16	27·2
23	17	6·9
24	17	46·6
25	18	26·3
26	19	6·0
27	19	45·7
28	20	25·4
29	21	5·2
30	21	45·0
31	22	24·8
Aug. 1	23	4·6

The chief dates connected with the astronomical seasons of *Mars* are :—

1888, Feb.	16.	Summer solstice of ♂'s northern hemisphere.
April	20.	Beginning of autumnal season of transits and eclipses of the satellites. First of about 663 transits of *Phobos* across the Sun's disc.
	23.	First of about 644 eclipses of *Phobos*.
July	6.	First of 56 transits of *Deimos*.
	8.	First of 54 eclipses of *Deimos*.
Aug.	15.	Autumnal equinox.
Sept.	14.	Last of 54 eclipses of *Deimos*.
	16.	Last of 56 transits of *Deimos*.
Nov.	14.	Last eclipse of *Phobos*.
	17.	Last transit of *Phobos*. End of autumnal season of transits and eclipses.
1889, Jan.	8.	Winter solstice of ♂'s northern hemisphere.
Feb.	25.	Beginning of vernal season of transits and eclipses. First of about 740 transits of *Phobos*.
	28.	First of about 722 eclipses of *Phobos*.
May	5.	First of 64 transits of *Deimos*.
	7.	First of 62 eclipses of *Deimos*.
June	7.	Vernal equinox of ♂'s northern hemisphere.
July	23.	Last of 62 eclipses of *Deimos*.
	25.	Last of 64 transits of *Deimos*.
Oct.	16.	Last eclipse of *Phobos*.
	19.	Last transit of *Phobos*. End of vernal season of transits and eclipses.
1890, Jan.	2.	Summer solstice of ♂'s northern hemisphere.